



Cardiovascular Training:

Energy Systems
Development

*Navy Operational
Fitness & Fueling Series
Athletes' Performance*

Common goals of cardio training



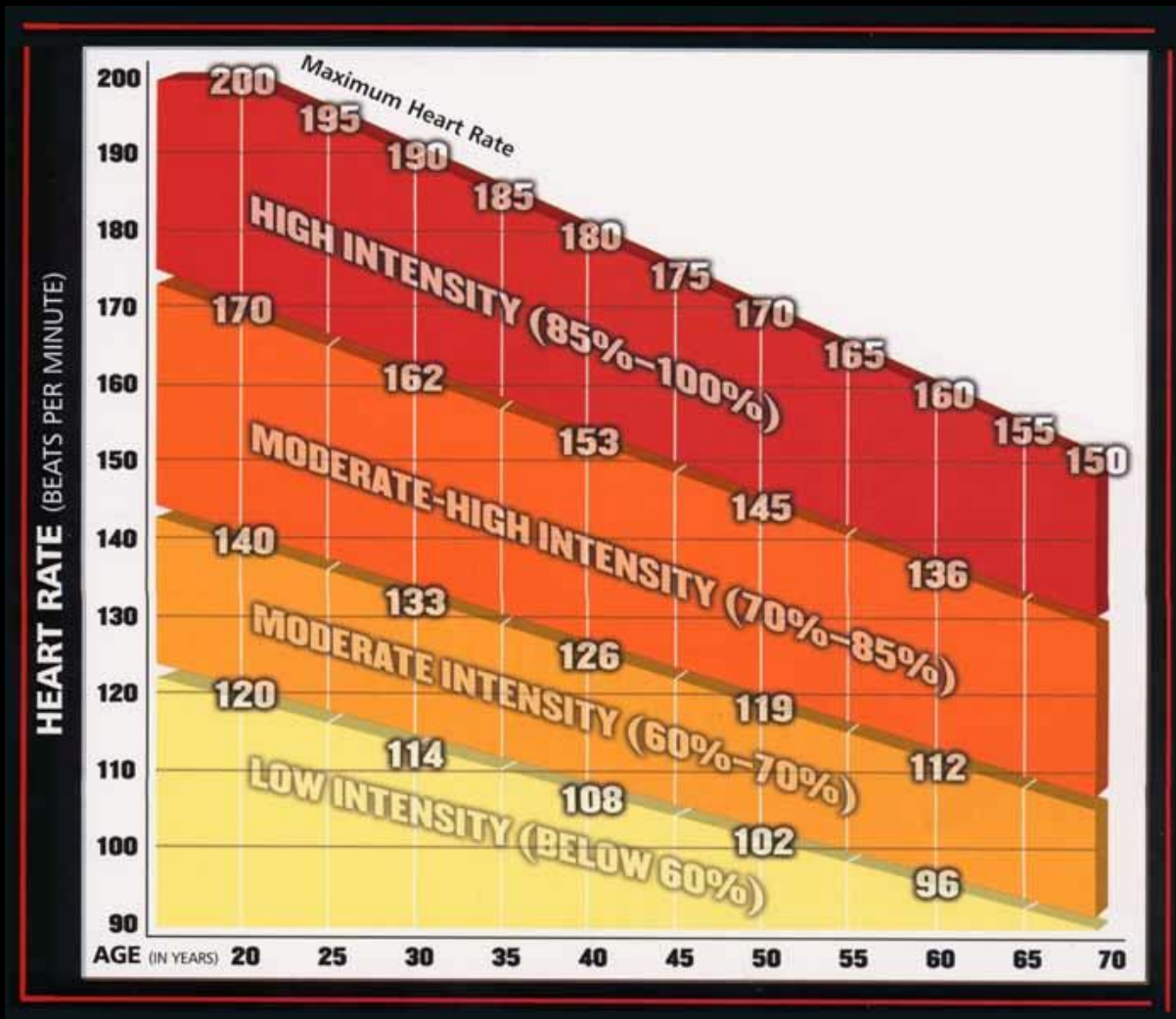
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- To improve performance in work, life and sports.
- To improve health by reducing cardiovascular risk factors (i.e. body composition, blood lipid profile, blood pressure, etc.).
- To reduce mental anxiety.
- Weight Management

Misleading Information



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The Origin of Dr. Haskell's Formula



Where did it come from?

"I've kind of laughed about it over the years," Dr. William Haskell (developer of 220-age heart rate formula) said. "The formula," he said, "was never supposed to be an absolute guide to rule people's training. But," he said, "it's so typical of Americans to take an idea and extend it beyond what it was originally intended for."

- The New York Times 4/24/01

Conclusions & Recommendations



Based on this review of research and application of HR max prediction, the following recommendations can be made;

Currently, there is no acceptable method to estimate HR max

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THE SURPRISING HISTORY OF THE "HR max=220-age" EQUATION
ROBERT A. ROBERGS AND ROBERTO LANDWEHR
Exercise Physiology Laboratories, The University of New Mexico

The Problem with Current Methods



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40 Yrs. - Sedentary

$$220 - \text{Age} = 180$$

$$\text{Fat Burning or } 65\% = 117$$

$$\text{Cardio Training or } 85\% = 153$$

40 Yrs. - 20 Yrs. Exercise

$$220 - \text{Age} = 180$$

$$\text{Fat Burning or } 65\% = 117$$

$$\text{Cardio Training or } 85\% = 153$$

ARE THEY REALLY THE SAME??



How hard should I work?

Heart Rate (HR) Based Training & Rate of Perceived Exertion (RPE)

How hard should I work?

Heart Rate (HR) Based Training

If you have a HR monitor you can measure the intensity of your workout based off of your HR response. These HR training zones can be created off of an estimate Max HR, based on the general formula-

$$\text{Max HR} = 220 - \text{Age.}$$

From this number use the percentages from the table above to determine your HR training zones for each interval intensity. During your training, if you notice your HR goes higher than your calculated Max HR, simply replace with the calculated Max HR with your observed Max HR and re-calculate the percentages for each HR zone.

Rate of Perceived Exertion (RPE)

Your Rate of Perceived Exertion (RPE) is a simple and effective way to determine the training intensity during the prescribed intervals. The scale goes from 1-10. A rating of 1 would be equivalent to standing still, while a rating of a 10 would be representative of the most strenuous level of activity you could possibly sustain. Here are some general guidelines to follow throughout your training.

Intensity	Rate of Perceived Exertion	% of Max Heart Rate
Easy	5 out of 10	65%
Moderate	7 out of 10	80%
Hard	9 out of 10	90%
Max	10 out of 10	100%

- 5/10** You should be moving with a purpose, but you should still be able to carry a comfortable conversation.
- 7/10** Your breathing should be more rapid and you should not be able to carry a conversation.
- 9/10** An extremely strenuous effort. Breathing should be rapid and the effort should be difficult to maintain.
- 10/10** Maximum effort. Give it all you got!



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INTERVAL TRAINING

Review of Energy Systems



- **Aerobic System**

Aerobic exercise is the ability of the body to take oxygen from the atmosphere, into the lungs, transfer it into the blood, and then pump it to the working muscles where it is utilized to oxidize carbohydrates and fats to produce energy. (5 RPE)

- **Anaerobic System**

Anaerobic fitness is the ability of the body to produce energy by metabolizing carbohydrates in the absence of oxygen. (7-10 RPE)

- **Anaerobic Threshold**

Anaerobic threshold can be defined as the point where, as intensity increases, a person shifts from aerobic metabolism to anaerobic metabolism. (7 RPE)

How we get the Zones



RER and Percent (%) Calories From Fats and Carbohydrates

RER	% Carbohydrates	% Fats
0.71	0.0	100.0
0.75	15.6	84.4
0.80	33.4	66.6
0.85	50.7	49.3
0.90	67.5	32.5
0.95	84.0	16.0
1.00	100.0	0.0

RER= VCO_2/VO_2 Measured During Rest Or Steady State Exercise
From: Physiology of Sport And Exercise, by Wilmore J.H. and Costill,
D.L., Human Kinetics, 1994, pp106



True Interval Training

Most client stay in one of two zones:

5 RPE- 65% MHR “old fat burning zone” which will burn:

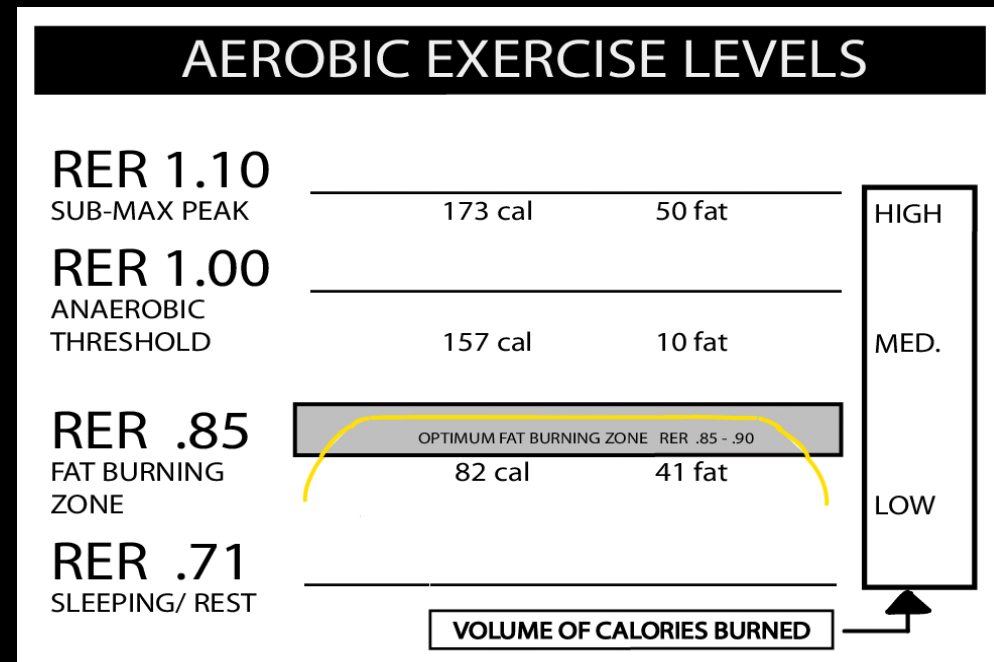
Small amount of calories -82 in the average 150 lb. person

41 calories could be from fat

They are aerobic!

Great for a base

Energy- higher
fat to carbs



True Interval Training

Other zones clients stay in is around **7 RPE**, 85% of MHR or near AT:

Burn more calories -157

but maybe only 10 calories could be from fat

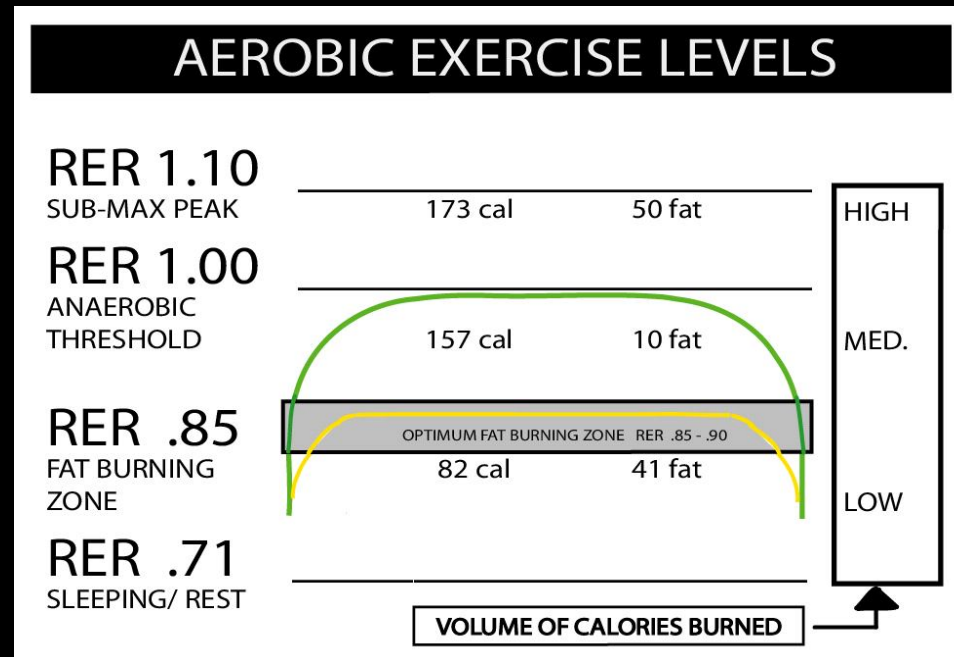
Close to AT

Energy

- Mainly carbs

Good for

- Endurance





Benefits Of True Interval Training

150 lb person riding for 30 minutes during True Intervals
at 65% (5) to 92% (9-10!) and back to 65% (5) of MHR will burn:

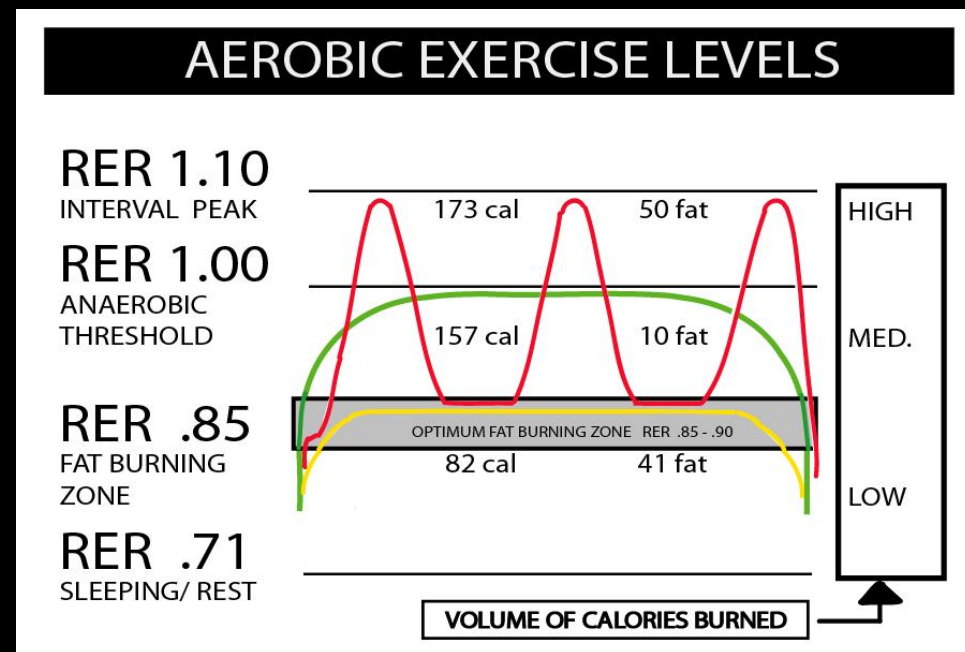
173 Calories

50 calories could be from fat

RER of .85- 1.1

Carbs

different intervals



Benefits Of True Interval Training



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1. Develops all energy systems

- I. Aerobic
- II. Anaerobic
- III. Peak- PC

2. Burns Calories

3. Increased Motivation

4. Increased cardio strength

5. Increased Metabolism



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PROGRAMS

Design Workout Programs



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Workout Goals

What is the Goal of the workout?

Improve Heart Rate Recovery

Increase Cardio Strength

Increase Leg Strength

Increase Endurance

Or just recover

Equipment Base



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Level 1



Stage:	Moderate	Easy	Short	Medium	Long
A	3 min	2 min	x2	x3	x4
B	3 min	2 min	x2	x3	x4
C	4 min	1 min	x2	x3	x4
D	5 min	1 min	x2	x3	x4

Level 2



Stage:	Hard	Moderate	Easy	Short	Medium	Long
A	1 min	2 min	2 min	x2	x3	x4
B	1 min	3 min	1 min	x2	x3	x4
C	1:30 min	X	1:30 min	x3	x4	x6
D	2 min	X	2 min	x3	x4	x5

Level 3



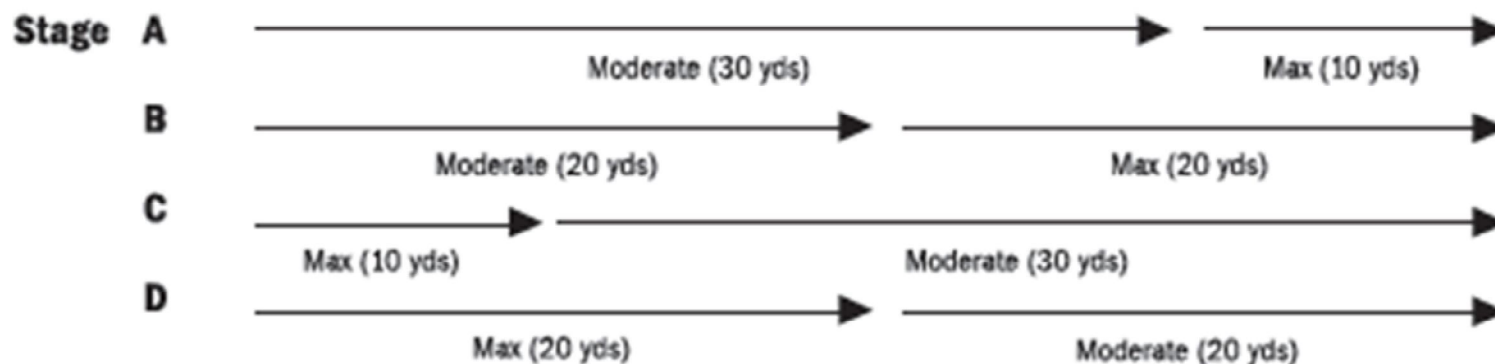
Stage:	Max	Hard	Moderate	Easy	Short	Medium	Long
A	X	:30 sec	X	1 min	x6	x10	x12
B	X	1 min	X	:30 sec	x6	x10	x12
C	:05 sec	X	:25 sec	:30 sec	x10	x15	x20
D	:10 sec	X	:20 sec	:30 sec	x10	x15	x20

Linear



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Stage:	Pattern	Work	Rest	● Short	● Medium	● Long
A	30 yds Moderate/ 10 yds Max	2 min	1 min			
B	20 yds Moderate/20 yds Max	2 min	1 min	x3	x5	x7
C	10 yds Max /30 yds Moderate	2 min	1 min			
D	20 yds Max /20 yds Moderate	2 min	1 min			

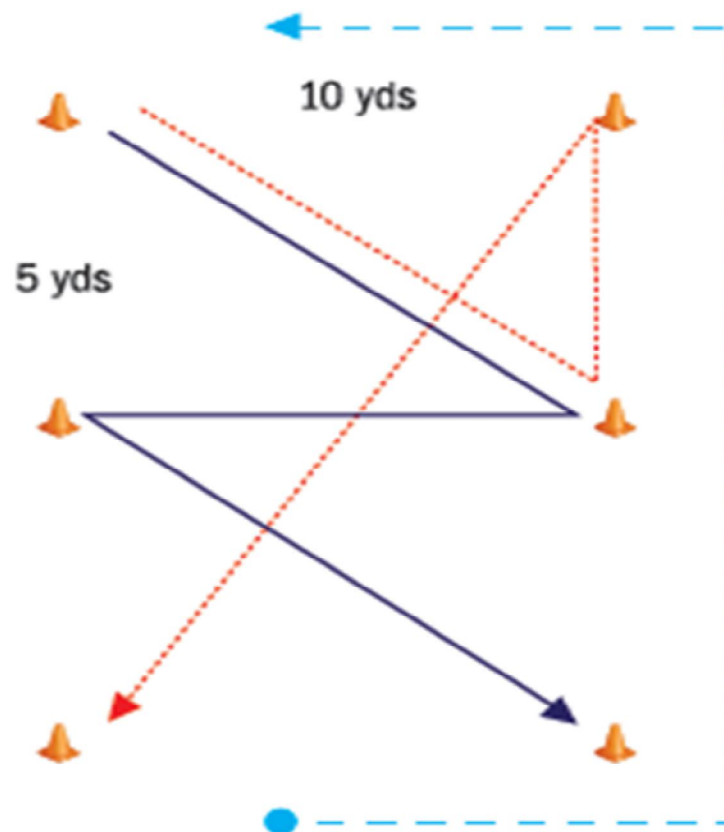


6 cone drill



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Stage:	Pattem	Work	Rest	● Short	● Medium	● Long
A	1	1:00	2:00	x2	x4	x5
B	1	2:00	1:00	x3	x5	x7
C	Alt. 1 & 2	1:00	2:00	x2	x4	x5
D	Alt. 1 & 2	2:00	1:00	x3	x5	x7



- ▶ Pattern 1
- ...▶ Pattern 2
- - - -▶ Jog back to the front of the cones

Metabolic Circuit



- Brings strength and movement together for cardio
 - Reverse lunge- :15- :30 work w/ 1:30/:30 rest
 - Pillar Bridge
 - Lateral Lunge
 - Worlds Greatest
 - **Rest :15**
 - Plank
 - Single Leg Balance
 - Split Squats
 - Drop Lunge
 - **Rest** (repeat 2-4x)



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Thank You.